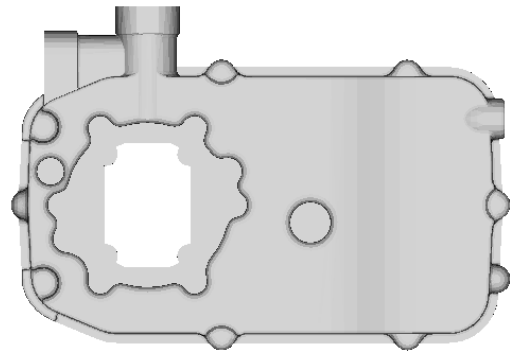


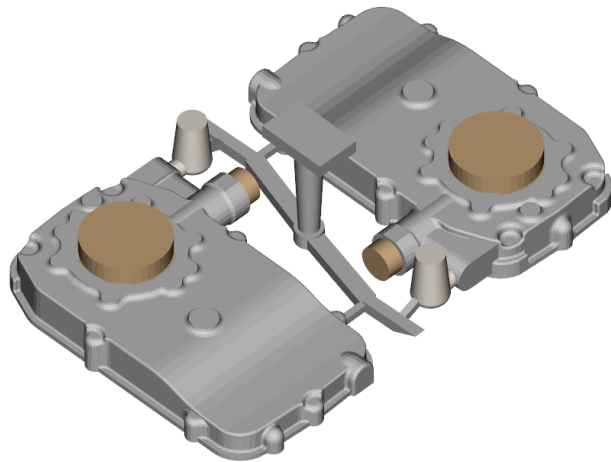
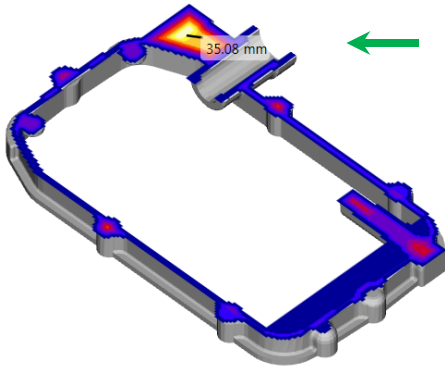
Gear Case

Cast Iron, Green Sand Casting

Case: A cast iron gear case casting is of overall size 371 mm x 256 mm x 51 mm and weighs 5.8 kg. It is produced by green sand casting process. Shrinkage porosity is observed at one side of the vertical opening and needs to be eliminated.

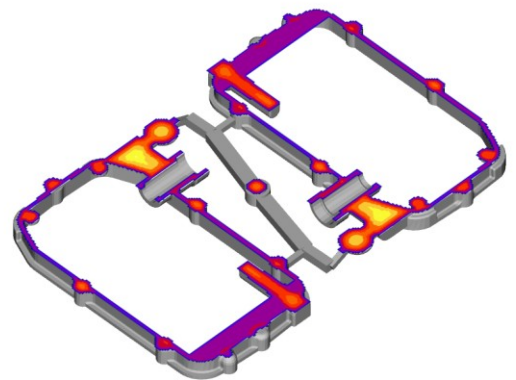


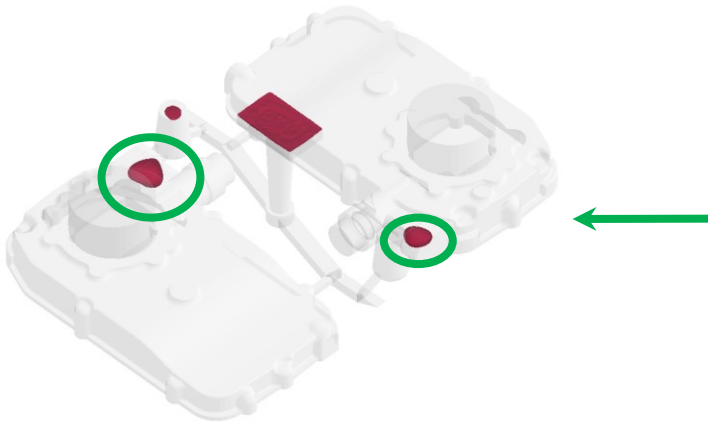
Wall thickness analysis shows a mass concentration of about 35 mm (inscribed sphere diameter) at one end of the casting.



The methods layout includes two cavities in mold, each connected to a feeder, and with a common gating system.

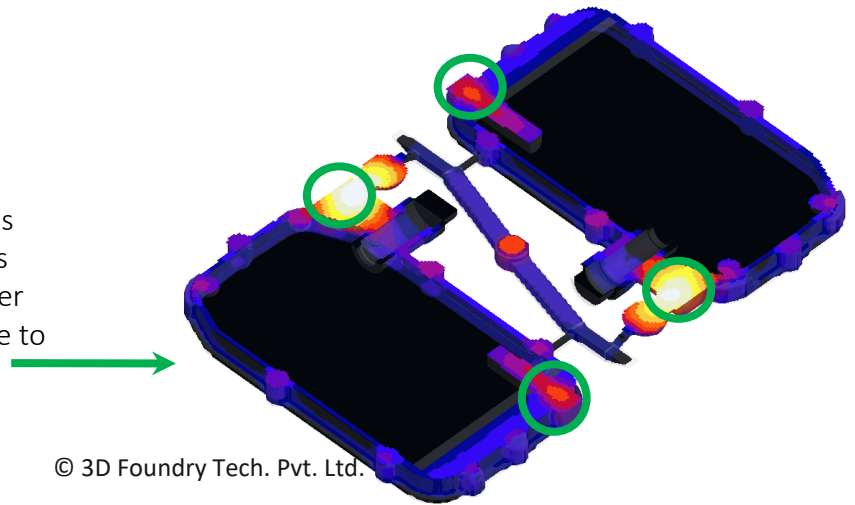
Solidification analysis shows a hotspot in the casting next to the feeder, matching the shrinkage found in the actual casting



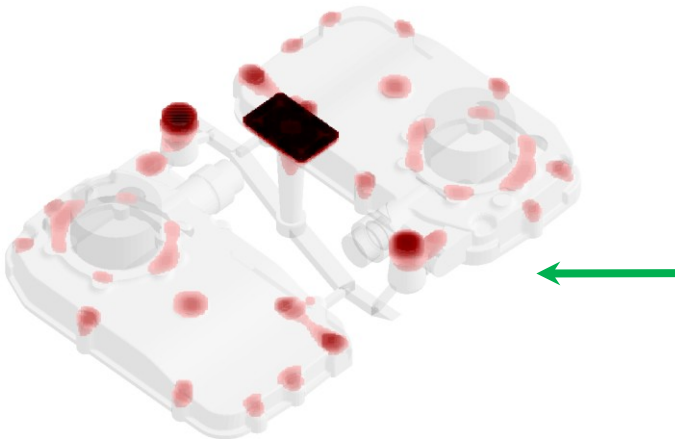


Liquid fraction analysis displays liquid metal remains inside the casting till the end of solidification. These locations can lead to shrinkage porosity.

Solidification time analysis gives locations where metal solidifies last. The locations next to feeder and bosses takes very long time to solidify.

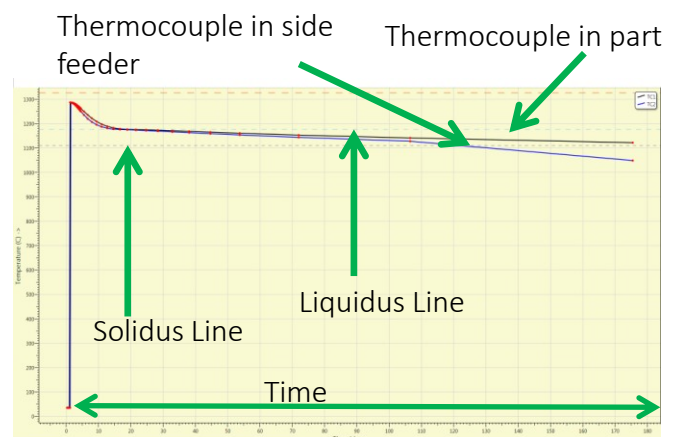


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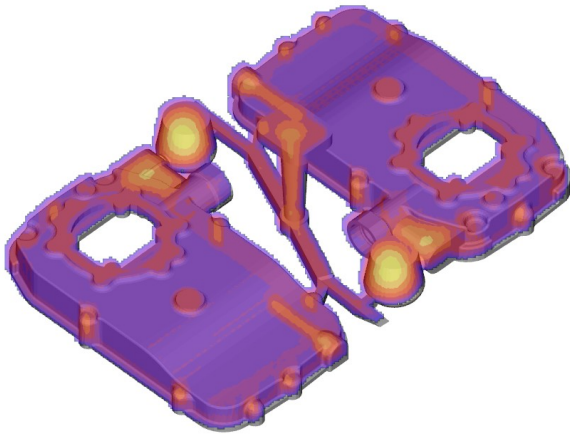
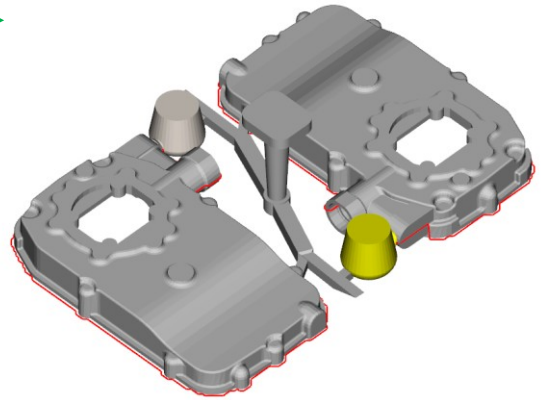


Shrinkage porosity is seen inside the bosses and section close to the feeders. The lighter colour shows micro shrinkages and darker colour shows macro shrinkages.

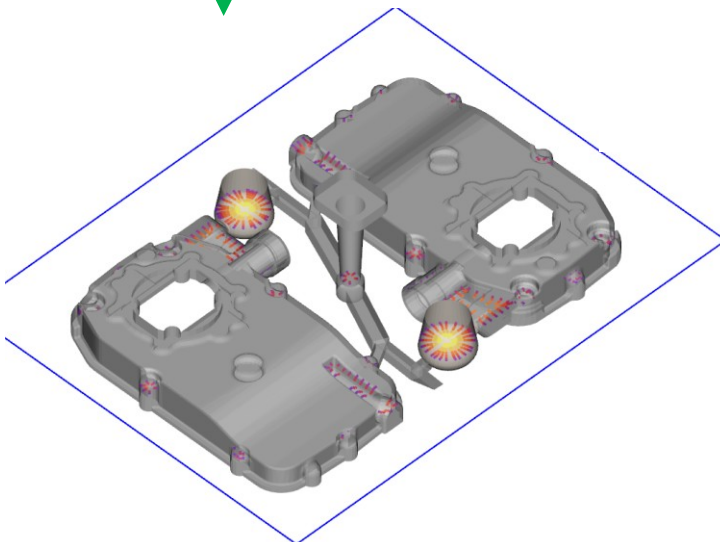
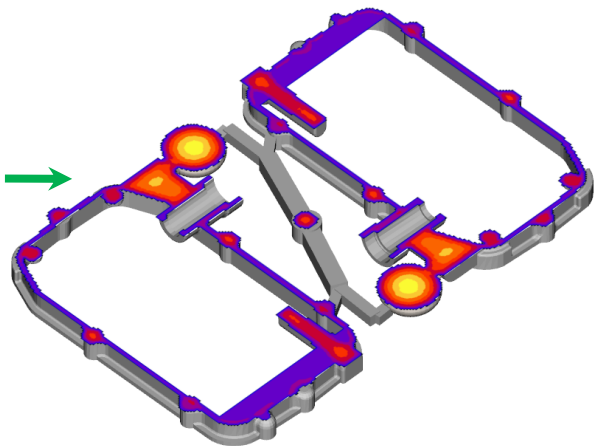
Thermocouple analysis reveals that section next to the feeder takes much more time than the connected feeder to cross solidification line which validates the result from shrinkage porosity analysis.



The methods design is revised by enlarging the risers to 50 mm top and 65 mm bottom diameter as well as the gating system, so as to ensure better and uniform feeding.



Solidification simulation of the new layout shows reduced hot spots at the defect-prone region. The sectional solidification and feed path analysis also confirm better feeding of the defect region.

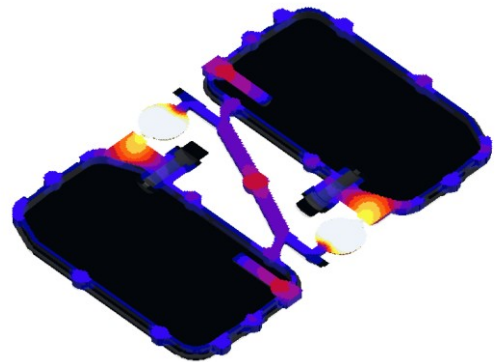
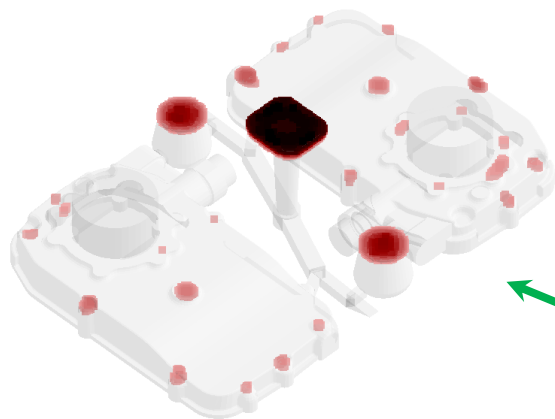




Liquid fraction analysis displays no liquid isolation in section next to feeder but some liquid isolation is still present in part.



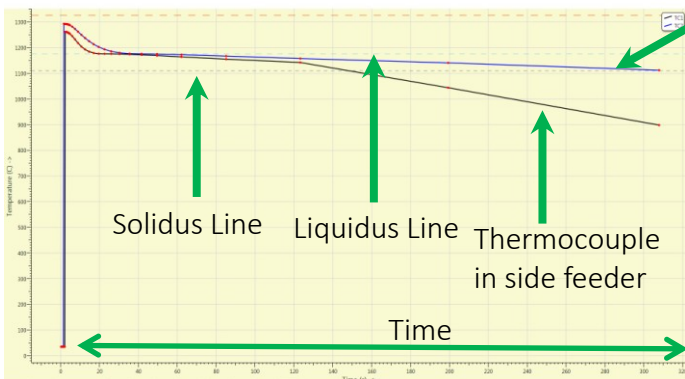
Solidification time analysis gives locations where metal solidifies last. Last solidifying metal is inside feeders.



Shrinkage porosity from section next to feeder is completely eliminated. Shrinkage porosity in bosses are still visible.



Thermocouple in part



Thermocouple analysis supports the shrinkage porosity results. Section next to feeder takes less time to solidify.

Summary: The feeder and the gating system layout was revised to address the feeding related defect. Defect from primary location is removed but chills should be placed under the defect area to reduce this possibility.